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Descriptors-Broadcast Reception Equipment, Closed Circuit Television, Educational Equipment, Educational Television, *Equipment Evaluation, Equipment Utilization, Instructional Technology, *Instructional Television, Learning, Media Technology, Merchandise Information, *Projection Equipment, Teaching Methods, Television, *Television Research
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Eidophor, a new control layer television projector that projects a television image on a large screen, in color as well as in black and white, was field tested at The Pennsylvania State University. Objectives of the investigation were to assess and compare the effects on learning of instruction presented by Eidophor on a large screen and in a large auditorium with simultaneous presentations of the same instruction on regular 24" television receivers in regular television classrooms, to test the acceptability of Eidophor among students and teachers; to explore other possible uses of Eidophor in a large university; and to collect data on Eidophor's dependability, maintenance, personnel requirements, installation and operating problems and costs. Results indicated the following: students learned as well in one situation as in the other, Eidophor will increase the usefulness of large auditoriums, for certain kinds of instruction and for many extracurricular activities, student accpetance is very high in a ratio of a two to one preference, little maintenance is required, and reliability is of a very high order. (GO)

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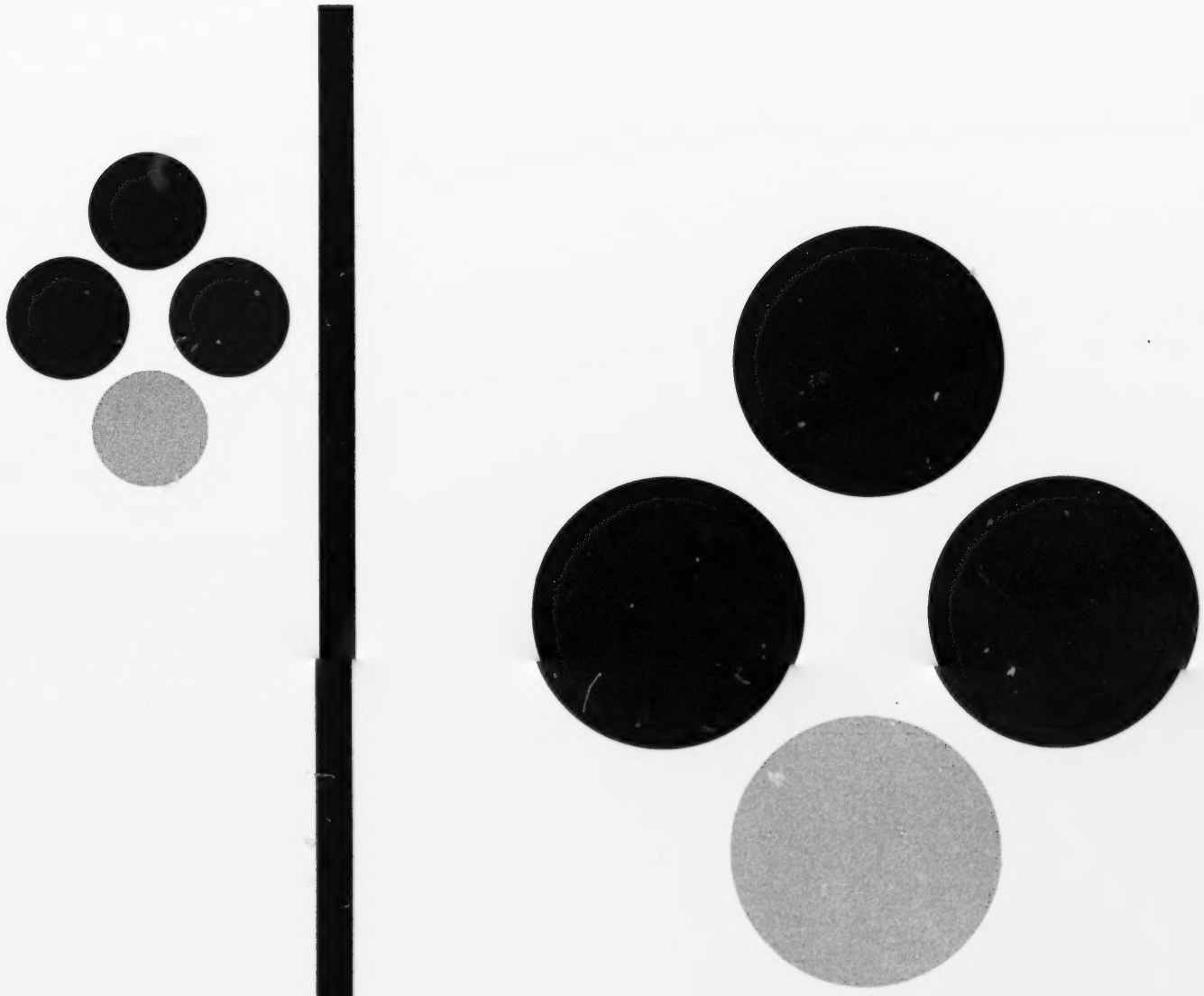

THE EDUCATIONAL EFFECTIVENESS, ACCEPTABILITY, AND FEASIBILITY OF THE EIDOPHOR LARGE-SCREEN TELEVISION PROJECTOR

RESEARCH CONDUCTED BY
THE DIVISION OF ACADEMIC RESEARCH
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THE PENNSYLVANIA STATE UNIVERSITY

EDO 30306

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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January 1962

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TABLE OF CONTENTS

		Page
	Foreword	V
1.	Introduction	1
2.	Studies of Comparative Instructional Effectiveness	5
3.	Studies of Student Acceptance	9
4.	Studies of Noninstructional Applications of Eidophor Television	15
5.	Other Instructional Applications	17
6.	Studies of Feasibility	19
7.	Visitors	23
8.	Conclusions	25
	Appendix	26

FOREWORD

There is a great need in education for new and advanced instrumentation and facilities for teaching and improving learning conditions. The constantly increasing demands on educational institutions can be met in part by new and advanced developments in the technology of communications.

Industry is developing new products which have direct applications in instructional and learning situations. Industry is also becoming interested in serving the needs of educational institutions and helping to solve their problems by producing facilities and equipment which are designed especially for instructional purposes.

Given these two developments, a third becomes both desirable and reasonable: the cooperation of educational institutions and industry in designing, producing, and especially in testing the effectiveness, appropriateness, acceptability, and feasibility of new educational technology and instrumentation. The work which is being reported here is an example of the testing of a new piece of equipment, *Eidophor*, a large-screen television projector, in the realistic context or "proving ground" of a large university.

It is conventional, in engineering procedures for the designing and building of new equipment, to establish technical standards and to continue research and development until these standards have been reached or exceeded. It is less common to include, especially in the specific area of educational instrumentation, the necessary step of establishing functional or operational standards (in terms of the requirements of teaching and learning) and to test equipment in relation to these standards.

Most often educational institutions must take the initiative and attempt to convince industry of the desirability of cooperative functional testing of equipment and facilities. Apparently industry often believes that when the technical engineering standards have been achieved the products are ready for production, sale, and distribution.

The relations between The Pennsylvania State University and Eidophor, Inc., a subsidiary of CIBA, in 1959-1960 were rather unusual on several scores. The management of Eidophor, realizing the need to put the television projector through realistic field tests in education, proposed a cooperative project to the University. The testing and evaluation project was planned and approved by both parties to the agreement. Aware of the economic conditions which affect the operations of most universities, Eidophor, Inc., provided the equipment for testing in an educational context and fully supported the project during one year of the "proving ground" operation. The arrangements could be viewed as a model for other educational-industrial cooperative research on new facilities or equipment.

It is important to report, furthermore, that the University was given complete freedom to test and study the equipment. Eidophor, Inc., provided limited training and maintenance support. There was no intervention, however, in the specific definition of problems, design of assessment procedures, or the collection and treatment of data. It was understood that the equipment must prove itself in terms of its

performance merits. The principal evaluations were to be in terms of hard evidence critically evaluated.

This report presents the evidence from the first year of testing. It is anticipated that a second year of field testing and realistic operation will yield additional evidence, especially on questions of practicability, feasibility, and cost analysis.

Since this project was initiated the distribution of Eidophor projectors in the United States has been transferred to Theatre Network Television, Inc., of 575 Madison Avenue, New York, New York. This company and CIBA have joined together to make possible the second year's study of Eidophor.

A number of improvements have been made in the projector, especially in light output, since the introduction of the model tested at Penn State. Furthermore, during the past year or so there have been extensive applications of Eidophor to commercial and military uses.

Finally, acknowledgment should be made of the cooperation of Drs. T. H. Cheng, R. M. Colwell, and A. H. Reede of The Pennsylvania State University, who made their classes available for the experiments described in this report. Without their assistance it would have been impossible to carry out these studies.

C. R. Carpenter
Director
Division of Academic Research
and Services
January, 1962

1. INTRODUCTION

BRIEF DESCRIPTION OF EIDOPHOR

Eidophor is a new control layer television projector which projects a television image on a large screen. It is available in models which project color or black and white images. This study is concerned with the black and white model.

Eidophor produces a large picture which is bright and sharp. Under conditions of total room darkness the black and white model will produce a picture as large as 24 by 32 feet. In the study reported here an image of approximately 11 by 14 feet was used, which permitted enough general illumination in the auditorium for the students to take notes. The projector was installed in Schwab Auditorium, which has a seating capacity of 1,200. Details of the installation are given in Section 6.

The basic elements of the control layer process are as follows: electrical impulses from the television cameras control an electron beam which bombards and thus modifies the surface of a film of oil on a concave mirror. Light passing through the resulting "wrinkles" in the oil film is projected through a special grating onto the screen. This modulated light beam produces the image on the screen.

This control layer system differs fundamentally from the Schmidt system employed by most other television projection systems. Whereas the Schmidt system projects an image from a high intensity television tube through a large-aperture optical system, the Eidophor system uses an electro-optical control of a light beam from an outside light source to produce the picture. The light output is thus limited mainly by the power of the light source, which in the case of the projector used in the study was an 1,800-watt xenon arc.

The control layer system of television projection was invented in 1939 by Fritz Fischer, a professor of applied physics at the Swiss Federal Institute of Technology in Zurich, Switzerland. After World War II the system was further developed, and manufacture of the projector was undertaken by the firm of Gretener A. G. of Zurich, which had been formed with the backing of CIBA, the Swiss pharmaceutical company.[1]

BACKGROUND OF THE PROJECT

The United States affiliate of CIBA, CIBA States Limited, inquired whether the Division of Academic Research and Services at Penn State would be interested in investigating the educational applications of Eidophor to a large university. Because of the research the University had conducted on the use of closed-circuit television for classroom instruction, Penn State was very interested in exploring the possibilities of Eidophor in a realistic field testing context and the effects of image size on learning. Accordingly an agreement was reached whereby Eidophor, Inc., (a subsidiary of CIBA) would loan the University an Eidophor projector and would provide a grant to cover installation, operation, and research for one year, with the possibility of further continuation.

In addition to providing an opportunity for research on large-screen television projection, it was felt that a permanent installation would provide edu-

1. The above information was abstracted from a bulletin entitled *Eidophor—A Control Layer Television Projector,* published by CIBA, 260 Madison Avenue, New York, N. Y. Further information is available from Theatre Network Television, Inc., 575 Madison Avenue, New York, N. Y.

cators with an opportunity to observe Eidophor in use under realistic conditions and would test the reliability of the projector when in daily use. These expectations were realized and a great many visitors from all over the United States, in addition to several thousand people from Penn State, saw Eidophor in action.

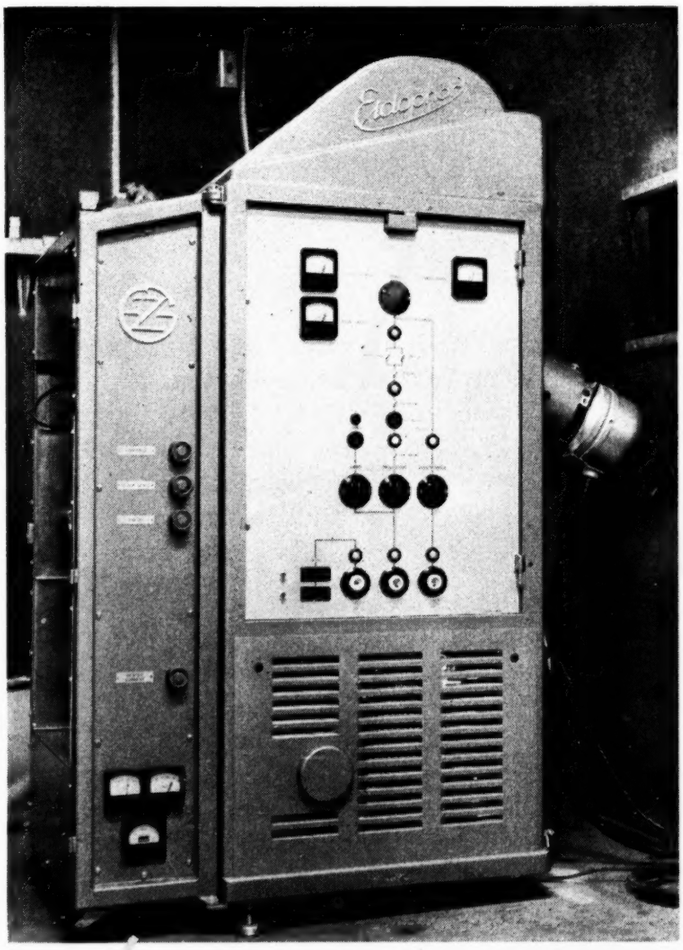

Figure 1 An exterior view of Eidophor showing the control panel.

GENERAL PROBLEMS TO BE STUDIED

The general problems to be studied were the following:

a. To determine the relative effects on learning of instruction presented by Eidophor on a large screen and in a large auditorium as compared with simultaneous presentations of the same instruction by means of regular 24-inch television receivers in regular television classrooms. A variety of courses were studied.
b. To assess the acceptability to students and faculty of Eidophor as a medium of televised instruction.
c. To explore other possible uses of Eidophor in a large university.
d. To collect data on such questions as dependability, maintenance, personnel requirements, and installation and operating problems and costs.

SPECIFIC PROBLEMS INVESTIGATED DURING THE FIRST YEAR

During the first year studies were conducted under the following headings:

a. Studies of Comparative Instructional Effectiveness

Fall 1960 semester—Zoology 25
Spring 1961 semester—Accounting 1

The two courses listed above were chosen because they appeared to make extensive, but different, demands on visual acuity. If large-screen television had advantages they should show up in these courses.

b. Studies of Student Acceptance

Fall 1960 semester—Economics 14
Spring 1961 semester—Zoology 25

The principal measure of this acceptance was a choice of viewing location offered to students in the above televised courses after they had seen both large-screen presentations on Eidophor and small-screen presentations on regular 24-inch television receivers. Additional data were secured by the use of questionnaires.

c. Studies of Noninstructional Uses

An effort was made to determine what noninstructional uses might be made of Eidophor in a large university. Accordingly the system was used for bringing television programs of national importance to students and faculty (e.g., the Kennedy-Nixon debates) and for accommodating overflow audiences from special local events such as wrestling and gymnastics meets, which were telecast by the University's closed-circuit equipment and shown on Eidophor. Reactions to these uses were obtained by means of questionnaires.

d. Other Instructional Applications

Several other instructional uses of Eidophor were tried, but not under experimentally controlled conditions. These included the accommodation of large numbers of students in Sociology 1 and the televising of demonstrations for the general education courses in the arts and biology.

e. Studies of Feasibility

In order to obtain data on feasibility, records

were kept of installation, maintenance, and operational problems. Measurements were made of light output in comparison with that from a 16-millimeter projector of the type generally used in the auditorium. Information concerning operating personnel was also obtained.

Studies "a" through "e" will be discussed in detail in the following sections of this report.

2. STUDIES OF COMPARATIVE INSTRUCTIONAL EFFECTIVENESS

The first group of studies sought to measure the relative effectiveness of instruction presented simultaneously to students in a large auditorium (1,200 seats) by means of Eidophor and to students in regular television classrooms equipped with 24-inch television receivers.

In these studies the measure of learning was student performance on several examinations given during the semester and on a final examination in each course. The tests used were analyzed for reliability.

In order to reduce systematic biases in the comparison groups, students were randomly assigned to the different viewing locations. Ideally in such a study the viewing conditions would be identical except for screen size and method of projection. This would normally involve using both television presentation systems in the same large room. However, such a situation was not possible nor in some ways was it desirable. These studies therefore sought answers to the practical question, "How well do students learn from televised instruction presented by the *Eidophor projector in Schwab Auditorium* in comparison with students who receive identical instruction at the same time in *regular television classrooms using 24-inch receivers*?"

Every effort was made to keep sound levels adequate for the different conditions. Sufficient illumination was available in all rooms to permit students to take notes, and all rooms were reasonably well ventilated.

However, there were certain differences between the classes.

a. In the auditorium students were in a large group in a large space, whereas in the regular television rooms they were in smaller groups and in smaller areas.
b. In the auditorium the seats did not have tablet arms and students had to use portable lapboards for supporting their notebooks, whereas the other classrooms had tablet arms on the seats. Also the seats in the auditorium were upholstered, and those in the regular classrooms were standard wooden classroom seats.
c. The major difference between the two viewing conditions, however, was the experimental variable; that is, the methods of displaying the TV image and the relative image size. In the auditorium (where the Eidophor projector was used) an image 14 by 11 feet was projected on a motion picture screen. No student was located farther from the screen than six screen widths. In the regular television rooms 24-inch receivers were used, and these were arranged so that *no student was located further from the set than 12 times the width of the screen.* Thus, the students in the auditorium had a larger image and most were relatively closer to it than were those in the small classrooms.

Courses in zoology and accounting were chosen for the two separate studies of comparative effectiveness because these courses make extensive use of

visual presentations. Also both instructors had considerable experience in teaching these courses over television and were aware of the possibilities and limitations of the medium. The instruction in both courses originated from studios employing Dage 320 vidicon television cameras. The signals were distributed to the receiving points over coaxial cables.

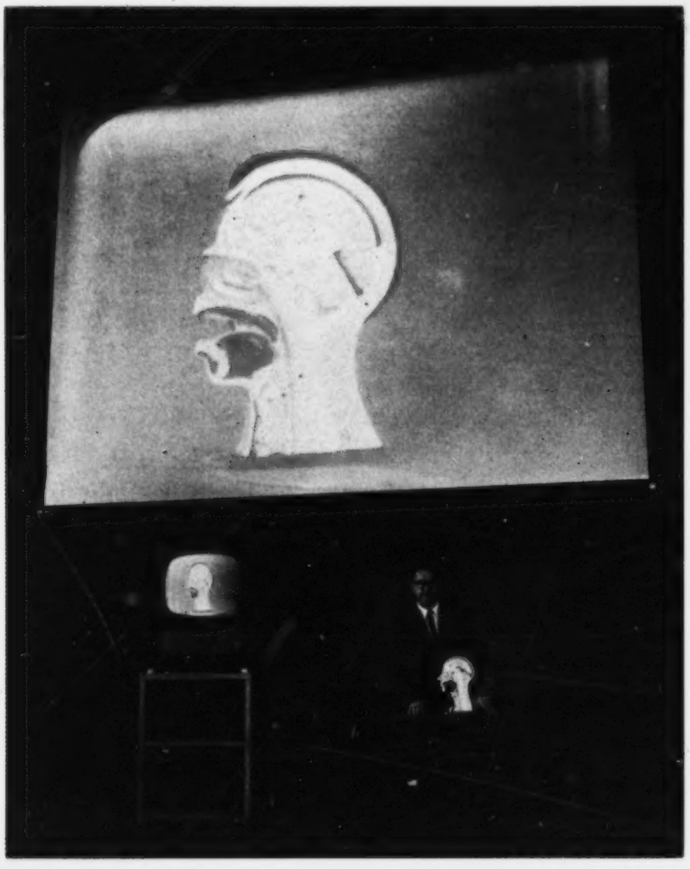

Figure 2 A size comparison between an actual model, an image on a 24-inch television receiver, and a projected image from Eidophor. The human subject provides a size scale.

There are many demonstrations in Zoology 25 involving small specimens, microscopy, models, film clips, slides, diagrams, and blackboard work. Accounting 1 involves the presentation of many figures in handwritten (on the blackboard), typewritten, and printed form. Both instructors provide their students with supplementary workbooks which require note-taking and other forms of concurrent activity during the television presentations. Both courses also supplement the televised lecture-demonstrations (two hours a week) with laboratory sessions.

EXPERIMENTAL DESIGNS

In general, similar experimental designs were used for the two studies of effects on learning. At the beginning of the semester the students were randomly assigned (by means of a table of random numbers) to the large auditorium (Eidophor) or to the smaller viewing rooms (24-inch receivers). In order to obtain precise tests of the significance of differences in the performance of the several groups, analysis of covariance was to be used, and aptitude test scores (Moore Castore), obtained from the University Registrar's Office, were to be used as the adjusting variable. The criterion of the .05 level of significance was used in evaluating all differences between groups.

ZOOLOGY EXPERIMENT

The experiment in Zoology 25 was conducted in the fall of 1960. The population of 506 students registered for the course was randomly divided into three groups. Group A, with a total of 213 students, was assigned to several 30-seat-capacity classrooms equipped with 24-inch receivers. Group B, comprised of 88 students, was assigned to a large 400-seat classroom equipped with six 24-inch receivers. Group C, with 205 students, was assigned to Schwab Auditorium (1,200 seats) equipped with Eidophor.

Each week during the 16-week semester two televised lecture-demonstrations were presented simultaneously to all the groups. Each group received three examinations during the semester and a final at the end of the course. Analysis of several sample tests developed by the zoology instructor indicated a high level of reliability. A coefficient of approximately .86 (using the Spearman-Brown split-half method for estimating reliability) was obtained on the final examination.

RESULTS

Tables 1, 2, 3, and 4 show the results of an analysis of covariance of the test scores for the three comparison groups on each of the four examinations. In each analysis the Moore-Castore Aptitude Test score was used for the adjusting variable. The adjusted mean scores of the comparison groups are also given in each table.

TABLE 1

Summary of Results of First Examination in Zoology 25

Source	SS	df	V	F	P
Treatments	122.47	2	61.24	.57	>.05
Error	53,913.28	502	107.40		
Total	54,035.75	504			

Treatment	N	Adjusted Means
Large screen (Eidophor)	205	76.49
Large classroom (24-inch receivers)	88	76.00
Combined small classrooms (24-inch receivers)	213	75.41

Correlation of adjusting variable (Moore-Castore Aptitude Test) and test scores = .432

TABLE 2

Summary of Results of Second Examination in Zoology 25

Source	SS	df	V	F	P
Treatments	168.37	2	84.18	.56	>.05
Error	75,485.20	502	150.37		
Total	75,653.57	504			

Treatment	N	Adjusted Means
Large screen (Eidophor)	205	74.46
Large classroom (24-inch receivers)	88	75.47
Combined small classrooms (24-inch receivers)	213	75.69

Correlation of adjusting variable (Moore-Castore Aptitude Test) and test scores = .330

TABLE 3

Summary of Results of Third Examination in Zoology 25

Source	SS	df	V	F	P
Treatments	12.69	2	6.34	.049	>.05
Error	63,143.75	490	128.86		
Total	63,156.44	492			

Treatment	N	Adjusted Means
Large screen (Eidophor)	202	74.07
Large classroom (24-inch receivers)	86	74.48
Combined small classrooms (24-inch receivers)	206	74.40

TABLE 4

Summary of Results of Final Examination in Zoology 25

Source	SS	df	V	F	P
Treatments	68.89	2	34.44	.37	>.05
Error	46,166.64	490	94.22		
Total	46,235.53	492			

Treatment	N	Adjusted Means
Large screen (Eidophor)	202	75.53
Large classroom (24-inch receivers)	86	76.23
Combined small classrooms (24-inch receivers)	206	76.31

Test reliability by split-half method = .856

As can be seen from the tables, the differences in mean scores were extremely small and in no case even approached significance at the .05 level. It must be concluded, therefore, that there were no significant differences in the performances of the groups taught under the three different sets of conditions. The study, therefore, shows that large groups of students can be taught in a large auditorium by use of the Eidophor projector under the conditions stated without measurable loss of learning. Furthermore, the availability of such a projection system makes it feasible to use a large auditorium for formal instruction, something which is otherwise difficult to accomplish.

ACCOUNTING EXPERIMENT

The experiment in Accounting 1 was conducted in the spring of 1961. It was thought that the extensive use made of figures in this course would make possible an even more rigorous testing of the possible benefits of large-screen television projection with a maximum viewing distance limited to six times the width of the screen. However, it should be remembered that the course had been designed for presentation over standard 24-inch television receivers and that all visuals had been designed for legibility (sometimes with difficulty) when viewed from a distance of 12 times the screen width.

From the total population of 223 students registered in this course, 55 were drawn at random and assigned to Schwab Auditorium for the two televised lectures per week. The remaining 168 students were assigned to 30-seat classrooms equipped with 24-inch television receivers in Boucke Building. The instruction was presented over closed-circuit by means of Dage 320 vidicon television cameras from a television studio located in Boucke Building.

In this course, during the 16-week Spring Semester 1961, there were three one-hour examinations, one unannounced test, and a final examination. Analysis of a previous test in the course showed a high level of reliability. Several of the tests used in the experimental study were also analyzed for reliability and showed very adequate coefficients ranging from .75 to .86 using the Spearman-Brown split-half method. The Moore-Castore general scholastic ability scores were again used as the adjusting variable in an analysis of covariance, but this time they had only a slight effect because of low correlations with the performance tests used.

RESULTS

Tables 5 through 9 show the results of an analysis of covariance on each of the five examinations. As can be seen from the tables, none of the differences in mean scores on the various tests reached the .05 level of significance. It is concluded, therefore, that there were no significant differences in the performance of groups taught in regular television classrooms and those taught in the auditorium.

TABLE 5

Summary of Results of First Examination in Accounting 1

Source	SS	df	V	F	P
Treatments	86.12	1	86.12	.86	>.05
Error	22,119.98	220	100.54		
Total	22,206.10	221			

Treatment	N	Adjusted Means
Large screen (Eidophor)	55	71.96
Regular 24-inch receivers	166	70.26

Correlation of adjusting variable (Moore-Castore Aptitude Test) and test scores = .115

Test reliability = .75

TABLE 6

Summary of Results of Second Examination in Accounting 1

Source	SS	df	V	F	P
Treatments	64.41	1	64.41	.12	>.05
Error	114,959.28	206	558.05		
Total	115,023.69	207			

Treatment	N	Adjusted Means
Large screen (Eidophor)	52	55.32
Regular 24-inch receivers	157	54.05

TABLE 7

Summary of Results of Third Examination in Accounting 1

Source	SS	df	V	F	P
Treatments	571.79	1	571.79	2.02	>.05
Error	55,871.88	197	283.61		
Total	56,443.67	198			

Treatment	N	Adjusted Means
Large screen (Eidophor)	50	67.56
Regular 24-inch receivers	150	63.70

TABLE 8

Summary of Results of Fourth (final) Examination in Accounting 1

Source	SS	df	V	F	P
Treatments	101.85	1	101.85	.43	>.05
Error	47,062.53	200	235.31		
Total	47,164.38	201			

Treatment	N	Adjusted Means
Large screen (Eidophor)	53	67.58
Regular 24-inch receivers	150	65.97

Test reliability = .856

TABLE 9

Summary of Results of an Unannounced Examination in Accounting 1

Source	SS	df	V	F	P
Treatments	53.79	1	53.79	.276	>.05
Error	39,512.71	203	194.64		
Total	39,566.50	204			

Treatment	N	Adjusted Means
Large screen (Eidophor)	49	73.93
Regular 24-inch receivers	157	72.72

As an additional check, the individual student's scores for each of the five examinations were totaled. An analysis of covariance using the Moore-Castore Aptitude Test as the adjusting variable was applied to the total examination scores. Table 10 shows the results of this treatment of data. Again there is no significant difference at the .05 level.

TABLE 10

Summary of Results of Total Test Scores for Accounting 1

Source	SS	df	V	F	P
Treatments	2,219.99	1	2,219.99	.98	>.05
Error	408,176.04	180	2,267.64		
Total	410,396.03	181			

Treatment	N	Adjusted Means
Large screen (Eidophor)	46	329.96
Regular 24-inch receivers	137	322.00

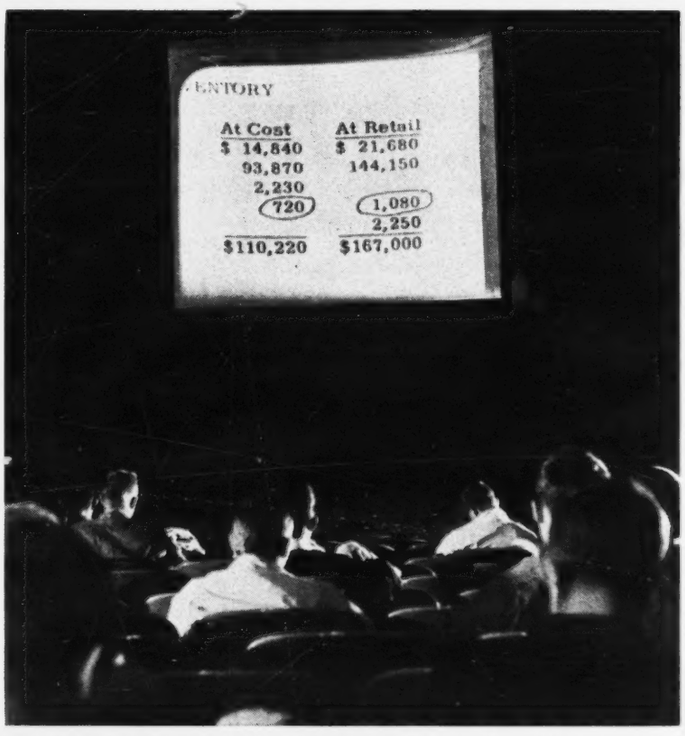

Figure 3 A scene taken during the presentation of an accounting course over Eidophor. The material on the screen is from a typewritten original.

SUMMARY OF RESULTS

In summary, it can be said that there were no measurable differences in the learning of students (in either the zoology or accounting courses) instructed in a small classroom using 24-inch television receivers and taught in a large auditorium using Eidophor. However, the availability of Eidophor has made it possible to use a large auditorium practically and effectively for regular televised instruction. It is true that this could possibly be done by means of many small receivers, but the auditorium is used for many different purposes and the positioning and storage of small TV sets is generally considered to be impractical.

3. STUDIES OF STUDENT ACCEPTANCE

It has become a fairly regular procedure to attempt to assess student reactions to new instructional methods. In particular, there have been numerous studies of student acceptance of televised instruction. In the study of the use of Eidophor it was considered desirable to measure student reactions to televised instruction in a large auditorium using Eidophor, and compare this with their reactions to televised instruction presented in regular classrooms over 24-inch television receivers.

It was decided to use a technique, developed earlier at The Pennsylvania State University,[2] which involved offering students a choice between two situations after they had been exposed to each. The students remain in the locations of their choice for a substantial period. Thus, their decisions are of some importance to them. The students are subsequently asked to fill out a questionnaire in order to ascertain some of the reasons why they made a particular choice.

Two such free choice behavioral tests were used in the Eidophor studies. One was conducted in Economics 14 during the fall of 1960. The other was conducted in Zoology 25 during the spring of 1961. Each of these studies will be described in some detail.

PREFERENCE STUDY IN ECONOMICS 14

Economics 14 is an introductory course on the principles of economics. It was taught by a professor with considerable experience in teaching over television.

The group of approximately 170 students enrolled in this course was split randomly into two equal groups. Subsequent dropouts reduced one group to 85 and the other to 81. During the first six weeks of the semester, Group A was assigned to the auditorium equipped with the Eidophor large-screen television projection system, and Group B was divided into subgroups and assigned to three 30- to 40-seat instructional television classrooms equipped with 24-inch receivers. At the end of the first six weeks Groups A and B exchanged locations. By the end of 12 weeks both groups had received equal exposure to Economics 14 as taught with the use of 24-inch television sets and as taught with the use of Eidophor.

Immediately preceding the conclusion of the second six-week period all students in Groups A and B received the following written notice:

"This is an important announcement for all students on the University Park Campus who are taking Economics 14 by television on Monday, Wednesday, and Friday mornings at 9:00.

"All of you have now had the opportunity of taking Economics 14 in the television rooms in Sparks Building for part of this semester and in Schwab Auditorium for another part of the semester.

"On Friday next, Dec. 2 at 9:00 A.M., you will be given the opportunity of choosing between attending the course in Schwab Auditorium or in Sparks Building. In other words, you may come, on Friday at 9:00 A.M., to Schwab Auditorium or to rooms 1, 2, 9, 12, or 18 Sparks, whichever you prefer.

2. Carpenter, C. R., Greenhill, L. P., et al. *The Use of Closed-Circuit Television for Teaching University Courses, Report No. 2.* The Pennsylvania State University, University Park, Pa. (Spring 1958), pp. 74-82.

"In order that you may satisfy yourself that you have made the most satisfactory personal decision, this free choice between Schwab and Sparks will be offered again on Monday next, Dec. 5th.

"Please note that the location you choose on Monday, Dec. 5, will be final and you will be required to attend Economics 14 classes for the rest of the semester in the location in which you appear on Monday."

Details of the free choice were also explained by the instructor during regular lecture periods.

There were 166 students in the combined groups of which 106 (63.8 per cent) chose the auditorium equipped with the Eidophor large-screen television projection system, and 60 (36.2 per cent) chose the regular instructional television classrooms. Table 11 shows the student movement as a result of the free choice.

TABLE 11

Results of Free Choice Between Conventional Television Classrooms and Auditorium Equipped with Eidophor Large-Screen Television

Economics 14

Location Preference (free choice)

	Auditorium	Regular Television Classrooms	Total
Number choosing location	106	60	166
Percentage	63.8	36.2	100

Amount of Student Movement (free choice)

	Auditorium		Regular Television Classrooms	
	Number	Percentage	Number	Percentage
Group size prior to free choice	85	100	81	100
Students not moving	69	81	44	54
Students moving	16	19	37	46
Total in each location after free choice	106		60	

A few days after the free choice, students were given a questionnaire inviting them to indicate the reasons for their choice of location. Eighty-six (or 81 per cent) of the 106 students attending class in the auditorium and 59 (or 98 per cent) of the 60 students attending class in the television classrooms completed and returned the questionnaire. Tables 12 and 13 show the results of the questionnaire responses.

TABLE 12

Responses of Students Choosing Auditorium Indicating Reasons for Location Preference

Economics 14

Schwab Auditorium

Total number of students	106
Total number responding	86
A response of 81 per cent	

Responses

	Number	Percentage
Seats are softer (more comfortable)	46	54
Convenience of location	34	40
Easier to see (and/or watch)	34	40
Large screen	18	21
Size facilitates concentration	12	14
Better sound	9	10
Better picture (easier to follow audio-visuals)	7	8
No congestion	5	6
Because of Eidophor	3	4
Better lighting	3	4
Regular television screen too small to hold attention	2	3
Lighting could be better	2	3
Less confusion in learning	2	3
Position of screen	1	2
Atmosphere stimulates interest	1	2
Less noise	1	2

TABLE 13

Responses of Students Choosing Conventional Television Classrooms Indicating Reasons for Location Preference

Economics 14

Sparks Building

Total number of students	60
Total number responding	59
A response of 98 per cent	

Responses

	Number	Percentage
Schwab conducive to sleep	21	36
Easier to take notes on desk than on lapboards	21	36
Lighting better (poor in Schwab)	11	19
Location more convenient	10	17
Sparks more conducive to classroom work	8	14
Smaller classroom quieter (less distraction)	5	8
More receptive to material (because of smaller classroom)	4	7
People near, to question about a missed point, etc.	2	3
Cold (in Schwab)	2	3
Warm (in Schwab)	2	3
Seats too small in Schwab (leg room)	2	3
Closer to television screen in small rooms	1	2
I was here before	1	2
More room	1	2
More comfortable	1	2
Television clearer and brighter	1	2
Prefer Eidophor, but ... (reason given above)	3	

An attempt was made to group the above responses into several major categories. Tables 14 and 15 give the results of this classification.

TABLE 14
Grouped Responses of Students Choosing Auditorium Indicating Reasons for Location Preference
Economics 14

	Responses	Percentage of Totals
Better physical facilities in auditorium	46	27.1
More convenient location	34	20.0
Like large viewing screen (Eidophor)	72	42.3
Better sound	9	5.3
Other reasons	9	5.3
Total	170	100.0

TABLE 15
Grouped Responses of Students Choosing Regular TV Classrooms Indicating Reasons for Location Preference
Economics 14

	Responses	Percentage of Totals
Better physical facilities in small classrooms	67	72.0
More convenient location	10	10.8
Like 24-inch viewing screens	2	2.2
Better room light	11	11.8
Other reasons	3	3.2
Total	93	100.0

It is clear from this study that the students in Economics 14 preferred large-screen television in the auditorium almost two to one over regular classrooms with 24-inch receivers. Those choosing the auditorium did so principally because of the large screen, more comfortable seats, and more convenient location (for them). Those choosing the regular television classrooms did so because they preferred smaller rooms equipped with tablet-arm seats, the room light was better, and the location was more convenient for them. Actually the two locations were separated by only 150 yards.

PREFERENCE STUDY IN ZOOLOGY 25

A second behavioral choice study was conducted in Zoology 25 during the spring of 1961 (the learning experiment in zoology had been conducted during the previous semester). The study followed the same pattern as for Economics 14, with some minor differences.

From the total group of over 500 students enrolled in Zoology 25 for the spring of 1961, a subgroup of 180 was identified and divided randomly into two equal groups. Group A was assigned to the Schwab Auditorium (1,200 seats) equipped with the

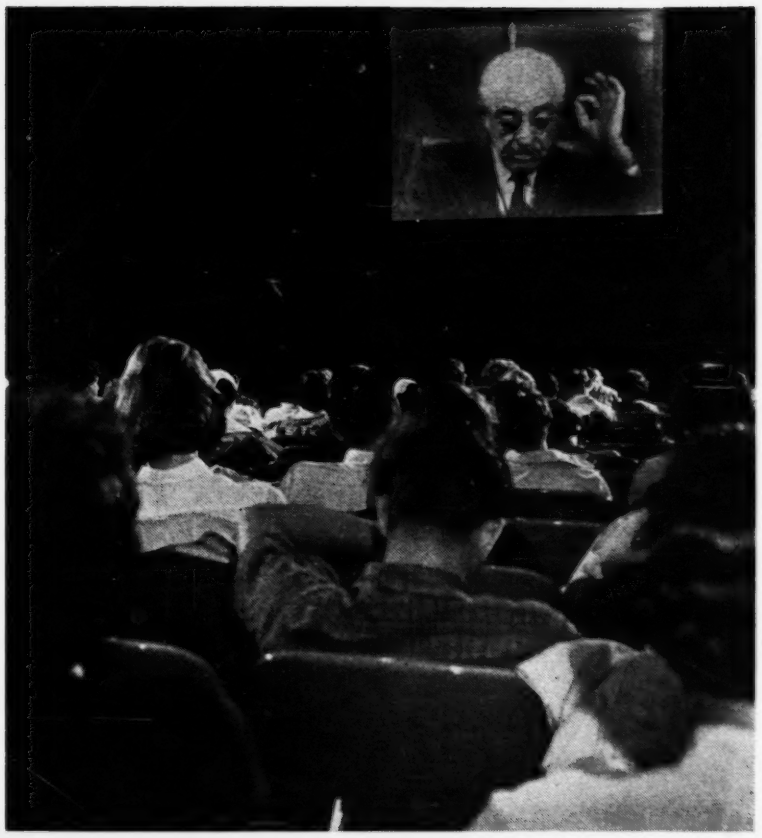

Figure 4 A professor of sociology emphasizes a point during a presentation over Eidophor.

Eidophor large-screen television projector. Group B was assigned to a large 400-seat classroom equipped with six 24-inch television receivers. After six weeks of instruction Groups A and B reversed locations for a second six weeks' period.

At this point a slightly different procedure was used. Instead of giving the students two periods for free choice of location on successive days, as was done in the Economics 14 course, the students were asked to write on a sheet of paper which location they would prefer for the remaining four weeks of the semester. In this way it was hoped to reduce the effects of inertia or habit patterns on the actual choice and to avoid the "compliance bias" often found to characterize the reactions of students.

Of the population of 173 in this study (there were a few dropouts) 133 (77 per cent) chose the auditorium with Eidophor, and 40 (23 per cent) preferred the large classroom with the six regular 24-inch receivers. On the basis of these expressed choices, students were assigned to their selected locations.

In this study a slightly different questionnaire was used to ascertain reasons for the students' choices and to get some information concerning the relative importance of several factors affecting their choices. Also, instead of making the questionnaire open-ended, a list of possible factors influencing the choice was given.

The students were also asked to rate each factor as having influenced their choice "very much," "to some degree," "not very much," or "not at all." These responses were then weighted on a 4, 3, 2, 1 scale. The total of the weighted responses for each factor was divided by 692 (the number of respondents, 173, multiplied by the highest weight, 4) and expressed as a percentage to give an "influence index."

Table 16 is a summary of the different factors which affected the students' choices of location. For example, 46 students considered the Sparks Building classroom a more convenient location, whereas 127 considered Schwab Auditorium more convenient. Twelve considered the 24-inch receivers in Sparks easier to watch, whereas 158 considered the large screen easier to watch.

TABLE 16
Responses of Students Indicating Factors Influencing Their Choice of Viewing Location
Zoology 25
Number of students responding—173

	Sparks Classroom	Schwab Auditorium
More convenient location	46	127
Seats more desirable	57	115
Lighting better	121	37
Blackboard and printed materials easier to see	12	158
Fewer distractions	35	123
Sound better	23	133
Television screen easier to watch	12	158
Models and demonstrations were easier to see	14	152
Holds attention better	33	128
Television screen size is more desirable	2	165

Table 17 shows the relative importance (established by weighting the responses described above) of the various factors affecting students' choices of viewing conditions. Ease of watching the screen and visibility of presentations were the most important factors. Type of seating and location of the building were of lesser importance. Room lighting (Sparks had much more general room light than was present in Schwab during television presentations) seemed to have a relatively low influence on the choice of location.

TABLE 17
Relative Importance of Factors Influencing Choice of Location in Terms of Degree of Influence
Zoology 25

Factors	Influence Index
Television screen easier to watch	83.5
Television screen size more desirable	81.1
Blackboard, pictures, printed materials easier to see	80.1
Models and demonstrations easier to see	78.2
Seats more desirable	77.3
Holds attention better	70.8
More convenient location	65.0
Better sound	60.0
Fewer distractions	58.4
Better room lighting	31.6

REACTIONS OF STUDENTS IN ACCOUNTING 1 TO A FULL SEMESTER OF INSTRUCTION TELEVISED OVER EIDOPHOR

To record the general impression of students who had received a full semester of study over Eidophor, a questionnaire was completed by those students who had taken Accounting 1 via Eidophor during the Spring Semester 1961. The questionnaire showed that 89 per cent of the students thought the picture quality of Eidophor to be as good as or better than that of regular 24-inch television receivers.

In response to the question, "Would you care to attend other large-screen television lecture courses?", 44.4 per cent reported "very much," 40.8 per cent reported "to some degree," 7.4 per cent reported "not very much," 7.4 per cent reported "not at all."

There were 77.4 per cent of the students who reported that they were able to see the blackboard, pictures, and printed materials "very well," and 22.6 per cent said they could see "fairly well." No students indicated they could see "not very well."

There were 44.4 per cent of the students who reported that they were able to concentrate on the Eidophor screen "very well," and 46.3 per cent who felt they were able to concentrate "fairly well." There were 9.3 per cent of the students who felt they could "not concentrate well" on the Eidophor presentation.

From the total responses we may conclude that the general reaction of the Accounting 1 students to Eidophor as a method of presenting instruction was favorable.

RELATIONSHIP BETWEEN CHOICE OF LOCATION AND STUDENT PERFORMANCE

After the room selections had been made in the zoology course it was decided to see whether choice of location was related to student performance. In other words did the better performers tend to choose one location or the other? To answer this question a "t" test was made between the performance of the students who chose the auditorium equipped with Eidophor and the performance of the students who chose the large television classroom in Sparks Building equipped with six receivers. The basis for determining performance was the mean score of each student on the four tests given in Zoology 25.

Table 18 shows that the average mean score of the students choosing the auditorium was 76.66 per cent and that of the students choosing the Sparks classroom was 74.7 per cent. The "t" test shows that the difference between these scores does not reach the .05 level of significance. It is concluded, therefore, that there is little relation between a student's performance in the course and his choice of viewing location.

TABLE 18

Results of "t" Test to Determine Significance of Difference of Group Mean Scores of Zoology 25 Students Choosing Conventional Instructional Television Classrooms and Eidophor Equipped Auditorium

Treatment	N	Mean Scores	t	P
Eidophor equipped auditorium	108	76.66	.356	>.05
Conventional television classroom	35	74.70		

SUMMARY

The data presented in this chapter show that student acceptance of televised instruction presented over Eidophor in a large auditorium was very high. Factors related to image size and visibility were most important in affecting individuals' choices of viewing location. Furthermore, there seems to be no relationship between choice of location and performance in the course.

4. STUDIES OF NONINSTRUCTIONAL APPLICATIONS OF EIDOPHOR TELEVISION PROJECTOR

There are many potential uses of large-screen television projection for universities and colleges. These uses may be grouped into two categories: (1) curricular or instructional, and (2) extracurricular or noninstructional. The study has thus far treated some of the curricular possibilities of large-screen television projection. Consideration will now be given to some of the noninstructional uses of large-screen television projection.

The educational process of the college student is not confined to the classroom but extends to all of his campus activities. Two of the major problems inherent in providing students in a large university with important noninstructional activities are student access to the location in which the event will occur and the facilities to accommodate large groups or audiences. Television makes it possible to provide student access to important national and local activities. The use of large-screen television projection offers a solution to the problem of providing for large audiences.

In order to obtain an indication of the usefulness of Eidophor for noninstructional or extracurricular activities two specific areas of interest were selected: first, the usefulness of large-screen television projection for presenting affairs of national interest and, second, for presenting campus activities to auditorium audiences.

RECEPTION OF TELEVISION PROGRAMS OF NATIONAL IMPORTANCE

The 1960 Nixon-Kennedy television debates were selected as events which could be used to ascertain the usefulness of Eidophor in presenting television programs of national importance to campus audiences. Since there had been no previous opportunity to demonstrate the Eidophor television projection system to the Penn State administration, the first Nixon-Kennedy debate was used for this purpose. On September 26, 1960, approximately 300 members of the faculty and administration, their wives and guests, observed the first debate in Schwab Auditorium via Eidophor. There was no attempt at measuring audience reaction; however, the general tone of audience response was very favorable.

The following three Nixon-Kennedy debates were opened to the faculty and general student body on the 7, 13, and 23 of October. A total of approximately 3,000 students, an average of approximately 1,000 per night, watched the debates via Eidophor. The general reaction of the students was favorable as was evidenced by the numbers attending and by personal comments.

PRESENTATION OF CAMPUS EVENTS ON CLOSED-CIRCUIT TELEVISION

The next series of events presented on the Eidophor large-screen television projection system were athletic contests. Of the six events (which included wrestling, basketball, football, and gymnastics) that were shown on the Eidophor system all but the Liberty Bowl football game originated on campus. The

audiences were either overflow audiences from Recreation Building or students who for various reasons preferred to see the event on the Eidophor system in Schwab Auditorium.

Schwab Auditorium had near capacity audiences (1,200) for three of the Eidophor-presented events. The other three events had estimated audiences of 40, 200, and 560. There are many factors involved in the great variation in attendance, including publicity, weather, competition with other activities, and interest in specific events. It was not possible in this first year's study to investigate the factors related to audience size.

At the final event in the series of athletic contests, the audience was asked to fill out a questionnaire designed to provide some indication of attitudes toward Eidophor when used for the presentation of such events. The questionnaire is included in the appendix. The results of the questionnaire are shown in Table 19.

TABLE 19

Results of Questionnaire Given to Special Events Audience

February 25, 1961

Total number of returned questionnaires—145

Number of events seen	Number	Percentage
Number of students seeing only one event	48	33.1
Number of students seeing two events	49	33.8
Number of students seeing three events	30	20.6
Number of students seeing four events	12	8.3
Number of students seeing five or more events	6	4.13
Number of students seeing two or more events	97	66

Reasons for attending wrestling on Eidophor tonight

	Number	Percentage
Schwab Auditorium more comfortable	74	39.2
Schwab Auditorium more convenient	73	38.6
Prefer Eidophor to seeing actual event	21	11.1
Bad weather	16	8.5
I can see all action better on Eidophor	5	2.6

(Note: Per cent is in terms of total responses to this single question)

Do you think it would be a good idea for the University to install the Eidophor television projector on a permanent basis?
Yes: 138 (95%) No: 4 (3%) Don't know: 3 (2%)

What is your impression of Eidophor picture quality?

	Number	Percentage
Equal to movie quality	14	9
Better than regular television	38	26
As good as regular television	59	39
Not as good as regular television	38	26

What is your impression of the quality of the sound?
Good: 137 (94%) Fair: 9 (6%) Poor: 0

It is interesting to note that of the 145 returning questionnaires, 66.8 per cent had seen other events on Eidophor, and 33 per cent had seen three or more, indicating a substantial repeat audience. The evening on which this survey was conducted was wet and Recreation Building, where the event was held, was not full. Thus, people attending in the Auditorium chose to do so.

From Table 19 it can be seen that comfort and convenience accounted for 78 per cent of the reasons for attendance. A preference for Eidophor accounted for approximately 11 per cent and all other reasons accounted for the remaining 11 per cent. This information suggests that for 78 per cent of the respondents the comfort and convenience of seeing the wrestling on Eidophor outweighed the opportunity of seeing the performance "live."

It should be noted that the light level for televising the wrestling matches was far below that recommended for optimum operation of the vidicon picture tube. (Approximately 30-40 footcandles in contrast to the recommended 200 footcandles.) Nevertheless, the audience response to picture quality as shown in Table 19 indicates that 74 per cent of those responding felt the picture to be as good or better than regular television. The same question was asked a group of students observing a course lecture where light levels in the originating studio were at approximately 200 footcandles. The response indicated that 89 per cent felt the picture quality was as good or better than regular television.

It should be remembered that the responses indicated above involve indirect comparisons dependent upon memory and lack of a fixed scale of measurement or comparison. This response is therefore a judgment value and is useful only as an indication of attitude.

5. OTHER INSTRUCTIONAL APPLICATIONS

After the Eidophor system had been installed, several instructional problems developed for which it was possible to use Eidophor, but not under experimental conditions. These additional uses will be described briefly.

a. BIOLOGICAL SCIENCE 1

Because the enrollments in this general education course exceeded 500 the course was moved from the 400-seat classroom, where it had been scheduled, to Schwab Auditorium. However, the professor teaching the course found that it was impossible to present demonstrations in the auditorium. The Division of Academic Research and Services made the Eidophor projector and closed-circuit television facilities available for the presentation of biological demonstrations.

The procedure worked as follows: the professor lectured in the Auditorium with occasional use of the blackboard. Whenever he wished to show a demonstration, it was arranged in advance and was performed by a teaching assistant. This was televised in the studio in another building and was viewed in the Auditorium over the Eidophor system. The results were very satisfactory.

b. THE ARTS

During the Spring Semester of 1961 enrollment in the general education course in the arts was high and the course was scheduled in the Auditorium. Demonstrations of a wide variety of objects and art processes were presented in the Auditorium over Eidophor. In this course the professor gave the lecture and demonstrations on various occasions from the television studio in another building, and students viewed the presentation via Eidophor.

c. SOCIOLOGY 1

The enrollments in the television section of Sociology 1 reached nearly 1,000 in the Spring Semester of 1961. Of this number over 400 students were located in Schwab Auditorium and received the lectures over Eidophor. The balance of the students were located in small television classrooms in Sparks Building. The televised lectures originated in the Sparks Building television studios.

6. STUDIES OF FEASIBILITY

An aspect of any new teaching equipment which is of special concern to educational administrators is the feasibility of purchase, installation, maintenance, and operation of the equipment. Especially important is its dependability under the kind of operating conditions normally found in an educational institution.

During the first year of operating Eidophor it was not possible to explore very fully the question of costs. However, requirements for the installation of Eidophor in a typical university can be described, and information was obtained on questions relating to operation, maintenance, dependability, and the kinds of personnel needed to manage the equipment.

It is planned to study the problem of economic feasibility next year. Eidophor is a relatively expensive device to purchase ($26,000) and requires an operator and rather careful maintenance. It is thought, however, that some of these costs can be offset by televising extracurricular events (e.g., athletic events) and charging admission. Since the first year of use of Eidophor was exploratory, a charge was usually not made for admission to athletic events shown on Eidophor.

INSTALLATION OF EIDOPHOR

Eidophor is designed to be installed in a projection booth in the rear of large auditoriums in a location similar to that provided for a motion picture projector. Therefore, it was decided to install the projector in the largest auditorium available at Penn State, the 1,200 seat Schwab Auditorium.

It was possible to construct a projection booth of 8 by 18 feet in the lobby in such a way that the front wall of the projection booth was formed by the rear wall of the auditorium. Part of the booth can be used as a ticket office when required.

Two ports, one for projection and one for the use of the operator, were cut in the rear wall of the auditorium. A platform one and one-half feet high was constructed on which to mount the projector so that its projection beam cleared the heads of the audience. The projection booth was ventilated by means of an exhaust fan in the ceiling.

To supply the projector and associated equipment with electric power a 50-ampere, 3-phase, 208-volt Wye connected line was provided. This was brought into the booth from the main power board in the auditorium.

Later it was found necessary to add dimmer controls to the booth for the auditorium lights so that the operator of Eidophor could control the light level in the auditorium. The booth was given some acoustical treatment to reduce noise.

In the booth were located the Eidophor projector, its DC rectifier (lamp power supply), video and audio monitors, video distribution amplifier (for line compensation), audio and video switching equipment, and a tuner for off-the-air reception.

The projector received its video signals on coaxial cable from either of two television studios located in other buildings with transmission distances of 500 feet and 2,700 feet respectively. Audio was received in the auditorium over a shielded pair of wires and interconnected with the existing public address system in Schwab Auditorium.

The distance from the Eidophor projector to the screen was 90 feet. With the standard Eidophor projection lens this location gave a picture approximately 11 feet high and 14 feet wide. (A wide angle lens giving a larger picture is also available.) The provision of a picture of this size meant that no student was located more than six screen widths from the picture (maximum viewing distance was about 84 feet).

The auditorium was already equipped with a fourteen-foot-wide, glass-beaded motion picture screen mounted on a motorized roller. It was decided to begin operations with this screen but to experiment with other types of screens. The stage in this particular auditorium is used for many purposes which precluded the installation of a rigid fixed screen and made it mandatory to use a screen mounted on a roller.

Later in the year comparisons were made of image brightness as viewed from a number of locations in the auditorium, using several different kinds of screens. These included two types of matte white plastic screen and a silver lenticular screen.

It was the consensus of the observers that the beaded screen provided the brightest image when viewed from the center section of the auditorium with rather rapid fall off in illumination when viewed from the sides. The matte white screens were greatly inferior in brightness when viewed from the center of the auditorium and were slightly better than the beaded screen when viewed from the seats at the sides of the auditorium.

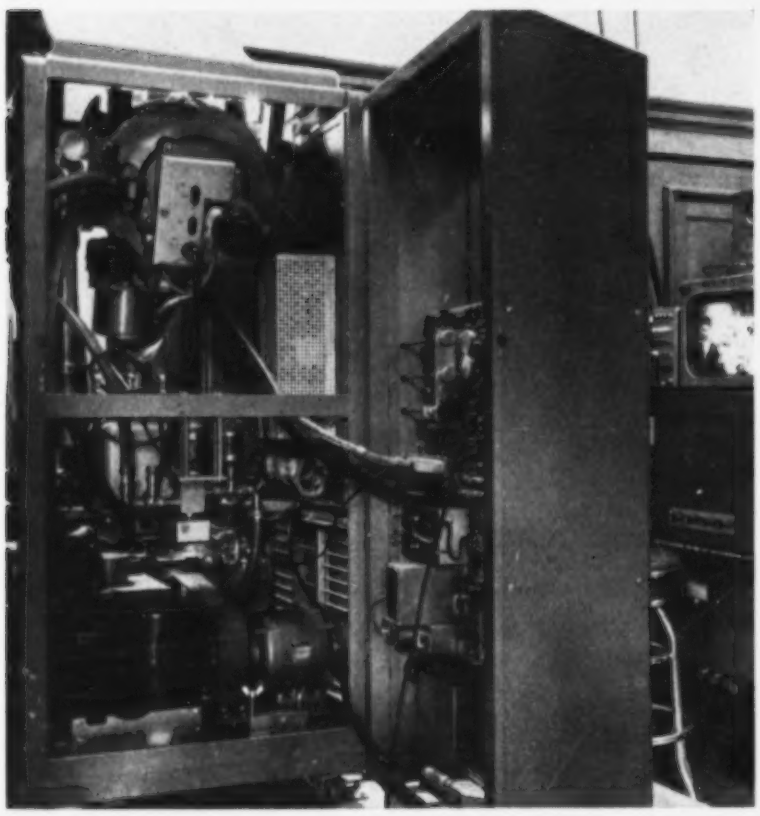

Figure 5 An interior view of Eidophor with the rear panel open. Monitoring equipment is on the right.

The silver lenticular screen offered the best compromise. It was not quite as bright as the beaded screen when viewed from the center portion of the seating area but was considerably brighter when viewed from the side sections of seats. Unfortunately a lenticular screen of the size needed was not available for mounting on a roller. A lenticular screen of this size must be mounted on a frame and stretched taut on all four sides. Where such a permanent mounting is feasible, a lenticular screen would be desirable. However, in Schwab Auditorium, where most students could be located in the best viewing area for a glass beaded screen and where a roller screen is essential, it was decided to use the existing beaded screen.

IMAGE BRIGHTNESS

After Eidophor had been in operation for some time, and after it had been adjusted for optimum operation, measurements were made of the amount of illumination projected onto the screen. As a basis for comparison, the illumination was also measured from the 16-millimeter sound projector which is normally used in the auditorium. This is a new Kodak projector with a 1,000-watt lamp, two-blade shutter for maximum illumination, and two-inch *f*1.6 projection lens.

The image size on the screen was the same for both projectors (approximately 11 by 14 feet). However, to obtain this size the Eidophor was located 90 feet from the screen and the 16-millimeter projector 75 feet.

The procedure was as follows: the film projector was set up and focused. Then the film was removed and, with the machine still running, incident light measurements were made at the center of the screen. Similarly, Eidophor was set up and focused with a picture, then the video signal was removed and the illumination was again measured at the screen center.

A standard Norwood 'Director' incident lightmeter was used. Equipped with the photodisc but with the light multiplier slide removed, the incident light on the screen was four footcandles from the 16-millimeter projector and eight footcandles from Eidophor. With the photodisc removed, the meter gave a scale reading of 20 from the projector image and 40 from Eidophor.[3] Thus, in terms of measured light

3. It is understood that the most recent Eidophor projectors have a "dual light path" which increases the output from the 1,800-watt xenon arc by 60 per cent over the model tested.

the screen illumination from this particular Eidophor projector with its 1,800-watt xenon arc appears to be twice as great as that of a high quality 16-millimeter projector with a 1,000-watt lamp. With both images side-by-side on the screen, the Eidophor image looks even brighter because of its blue-white color as compared with the yellow-white light from the sound projector.

AUDITORIUM ILLUMINATION

For the televised courses it was found to be essential to have sufficient illumination in the auditorium so that students could take notes and refer to study guides.[4] Schwab Auditorium is equipped with nine ceiling lights which have spotlight type fittings that direct illumination downward with relatively little scatter to the sides. For supplemental lighting, both above and under the balcony, the room is ringed with two banks of wall lights. These lights were originally on one circuit and were not on dimmers.

After some trial and error it was found that the best arrangement was to use the center horizontal row of three ceiling lights. These illuminated the central seating area of the auditorium to a level of about four footcandles. To provide light under the balconies the side lights were put on separate circuits and on dimmers so that a uniform level of about four footcandles could be obtained over the entire seating area. This proved to be adequate for note taking and resulted in very little scattered light reaching the screen (the actual level reaching the screen was too low to measure on the Norwood meter even with the photodisc and slide removed).

OPERATING PERSONNEL

It was found necessary to assign a technical person to operate and maintain the Eidophor projector. Operation involves turning the machine on and operating the pumping system about an hour in advance of use. When the machine is warmed up and the proper vacuum levels are reached the machine must be adjusted for optimum picture quality. Such adjustments require some skill, especially since there is a danger of shortening the life of the cathodes and other components if the correct procedure is not followed.

It was found in practice that Eidophor is rather sensitive to changes in the video levels coming from the television studio and it was therefore necessary for the projector operator to adjust Eidophor's picture fairly frequently as the director switched from one television camera to the other.

At The Pennsylvania State University, Eidophor has been successfully operated and maintained by personnel who had no previous experience with this type of equipment but who had worked as assistant television engineers on the University's closed-circuit television systems. Operators worked with Eidophor only for one semester in order that several staff members might gain the necessary experience. Both of these operators are in their mid-twenties. They are high school graduates with approximately two years of military service in electronics work. They worked under the supervision of the University's chief television engineer who could assist in the solution of any unusual difficulties. Several experienced engineers from Eidophor visited the installation at different times and gave valuable assistance in training Penn State's staff and in making basic adjustments to the projector.

RELIABILITY OF OPERATION AND MAINTENANCE OF EIDOPHOR

In evaluating the performance of this particular Eidophor projector it should be borne in mind that the one at Penn State is an early engineering prototype which had already received a good deal of use. During the year from September 1960 to August 1961 Eidophor was used for approximately 250 hours of actual class presentation, about 25 hours of special events, and about 40 hours of testing and maintenance—a total of 315 hours of actual operation. In addition, the vacuum pumps of the equipment were operated for a further 500 hours of "warm-up" time. Generally, the vacuum pumps were turned on an hour to an hour and one-half in advance of program time.

The best evidence of the reliability of Eidophor may be derived from the fact that during the 275 hours of actual presentations, not a single program had to be cancelled because of equipment failure. All electronic equipment requires maintenance and the replacement of certain components from time to time, and one of the main purposes of the present study was to determine what kind of replacements and adjustments Eidophor would need under regular operating conditions.

CATHODES

The component of Eidophor needing most frequent replacement is the cathode that generates the

4. For other noninstructional telecasts it was possible to operate with the auditorium lights turned off, and this, of course, greatly improved the picture brightness when the screen was viewed from the side areas of the room.

electron beam to provide a picture. The projector has been designed in such a way as to provide three cathodes in a magazine. When a cathode fails it takes about two or three minutes to change to a new cathode (about the time it takes to replace a hot projector lamp in a sound projector). Normally, several hours before a cathode fails evidence of impending failure is visible in the picture in the form of "white spots," and in fluctuations of the beam-current meters. During the 315 hours of operations, 12 cathodes were replaced. This indicates an average life of about 26 hours. The anticipated life of a cathode is 50 hours. Failure to reach this expected life was due in large part to the lack of experience of Penn State operators during the early use of Eidophor. The first replacements occurred after 5-10 hours of use; later replacement cathodes gave 50-60 hours of use. It is believed that a cathode with an expected life of 1,000 hours is under development.

VACUUM TUBE REPLACEMENTS

Vacuum tube replacements were much less than would normally be expected for this type of equipment. Only 12 tubes were replaced during the year. There were only one or two replacements of resistors or capacitors.

OTHER COMPONENT REPLACEMENTS

One 1,800-watt xenon arc lamp had to be replaced. This lamp had been used extensively before the projector was installed at Penn State. One water pump gasket had to be replaced.

MAINTENANCE

Eidophor received no unusual maintenance beyond the following of normal operating procedures recommended by the manufacturer.

In summary, it can be said that Eidophor is very reliable in operation for equipment of this type and degree of complexity.

7. VISITORS

One of the objectives of the study was to provide a realistic operational setting for Eidophor in a university, which would not only provide the necessary facilities for the educational experiment and field testing already described, but which would also be open for inspection by visiting educators. During the year over 125 people visited Penn State to see the closed-circuit television systems in action and to view Eidophor in operation. These people included educational administrators from other colleges and universities, visiting faculty members, and production and engineering personnel engaged in educational television at other institutions. In addition to these visitors many other people saw Eidophor in action in the presentation of courses and extracurricular programs. These included students, Penn State faculty and administration, local residents, representatives from the state legislature, and people from across the country who participated in several summer conferences that used Eidophor for the presentation of part of the conference. Visitors' reactions were generally very favorable toward the size and quality of the picture obtained from Eidophor.

8. CONCLUSIONS

The following tentative conclusions are based on the studies conducted during the first year of using the Eidophor television projector:

a. Students appear to learn as much from televised course instruction presented over Eidophor in a large auditorium as they do from the same instruction presented in smaller classrooms using regular 24-inch television receivers. This means that a large auditorium which would otherwise be unsatisfactory for presenting certain kinds of face-to-face instruction, especially instruction involving demonstrations, may be more extensively used for instructional purposes by means of an Eidophor television projector.

b. The use of Eidophor in a large auditorium is very acceptable to students as a means of presenting televised instruction. Students chose the Eidophor viewing situation over television classrooms employing regular receivers in a ratio of two to one or better.

c. There are many extracurricular activities for which the Eidophor television projector may be used to advantage on a university campus. These include overflow audiences for athletic events, special addresses and conferences, and for off-the-air broadcasts of special events of national importance.

d. Eidophor appears to be very dependable in operation. No programs were missed as a result of equipment failure during a year of regular operation. Eidophor can be operated and maintained by relatively inexperienced technical personnel after some training. From time to time such personnel may need assistance from a more experienced engineer; however, it has been found that they can cope with most situations after about three months of experience with the equipment.

e. In this first year of operation it was not possible to explore very fully the economic feasibility of operating an Eidophor projector. It is thought that operating costs might to some extent be offset by charging the public for admission to certain extracurricular activities (such as athletic events) shown on Eidophor. This aspect of Eidophor operation will be more fully investigated during the second year of the project.

APPENDIX

The Pennsylvania State University Eidophor Experiment

The Eidophor television projector in Schwab Auditorium has been loaned to the University for one year. The University is now evaluating its usefulness for regular instruction and for providing viewing opportunities for athletic events and television broadcasts of national importance.

Will you please give us your answers to the following questions?

1. Please check which category you are in:
   Student ☐ Faculty ☐ Visitor ☐
2. Please check which of the following events you have seen on Eidophor in Schwab Auditorium:
   a. A regular college course ☐
   b. Kennedy-Nixon debates ☐
   c. Liberty Bowl football ☐
   d. Wrestling: PSU vs. Army ☐
   e. Gymnastics: USSR vs. USA ☐
   f. Wrestling: PSU vs. Lehigh ☐
   g. Gymnastics: PSU vs. Army ☐
   h. Wrestling: PSU vs. Pitt ☐
3. Why are you viewing the wrestling on Eidophor tonight?
   a. Couldn't get seats in Recreation Building ☐
   b. Schwab Auditorium more comfortable ☐
   c. Prefer Eidophor ☐
   d. Schwab more convenient ☐
   e. Other reasons .....
   .....
4. What other types of events would you like to see shown on Eidophor?
   a. .....
   b. .....
   c. .....
5. Do you think it would be a good idea for the University to install the Eidophor television projector on a permanent basis?
   Yes ☐ No ☐ Don't know ☐
6. What is your impression of the Eidophor *picture* quality?
   Equal to movie quality ☐
   Better than regular television ☐
   As good as regular television ☐
   Not as good as regular television ☐
7. What is your impression of the quality of the *sound*?
   Good ☐ Fair ☐ Poor ☐
8. Please indicate, by putting an "X" on the following diagram, your approximate seat location: